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(54) **DRAWWORKS APPARATUS**

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(51) **Int. Cl.**
B66D 1/14 (2006.01)

(52) **U.S. Cl.** **254/294**; 254/278; 254/322

(58) **Field of Classification Search** 254/294, 254/312, 322, 278
See application file for complete search history.

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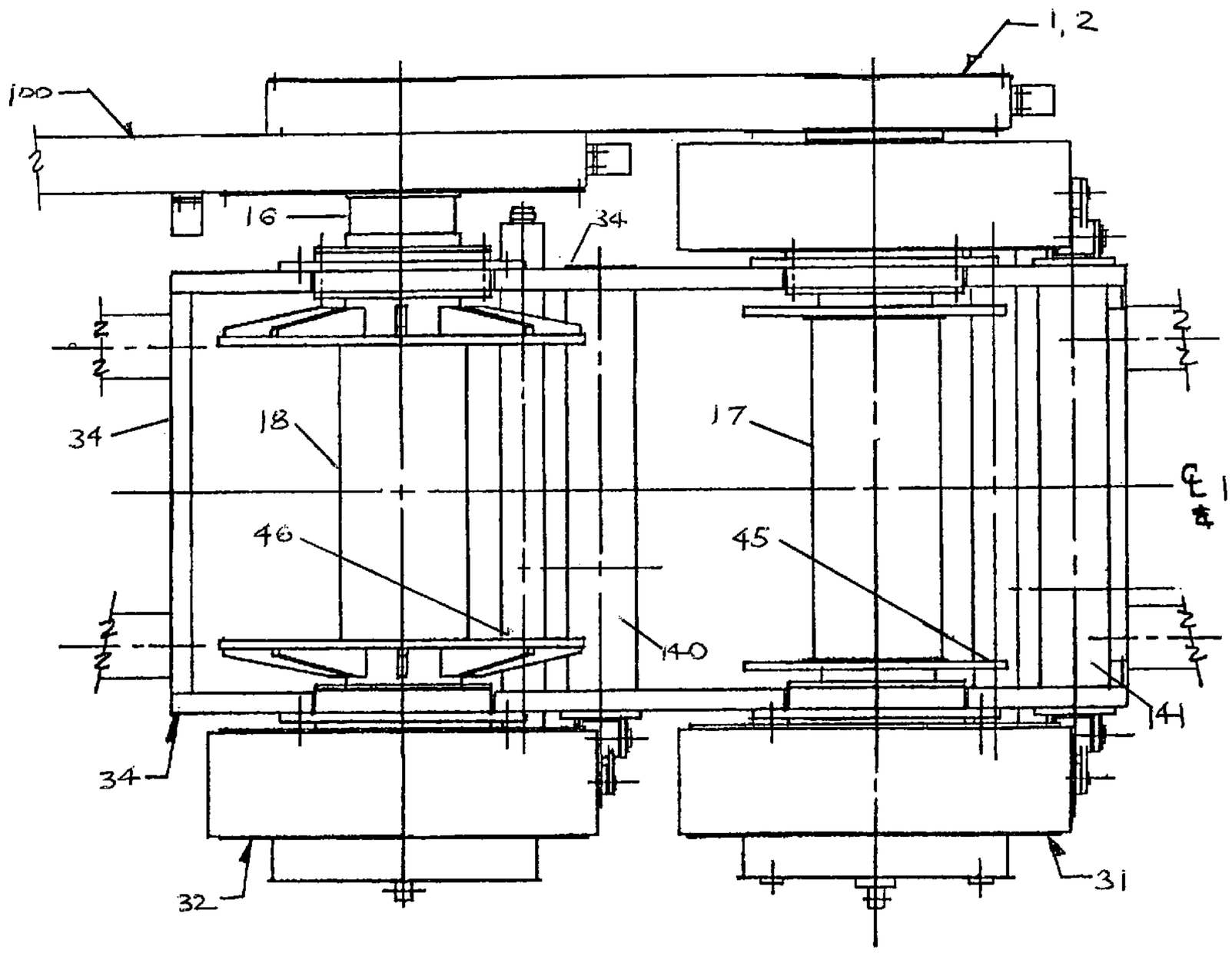
(57) **ABSTRACT**

A drawworks having a main drum spool, a main drum shaft which passes through and is rotatably and concentrically supported by the main drum spool, an auxiliary drum spool, respective drum shafts passing through and rotatably and concentrically supported by the drum spools in a manner in which wireline pull from the spools is isolated therefrom, a clutch mechanism rotatably connected to the shafts and brake mechanisms respectively connected to the main drum spool and the auxiliary drum spool outside the working area of the drawworks.

20 Claims, 5 Drawing Sheets



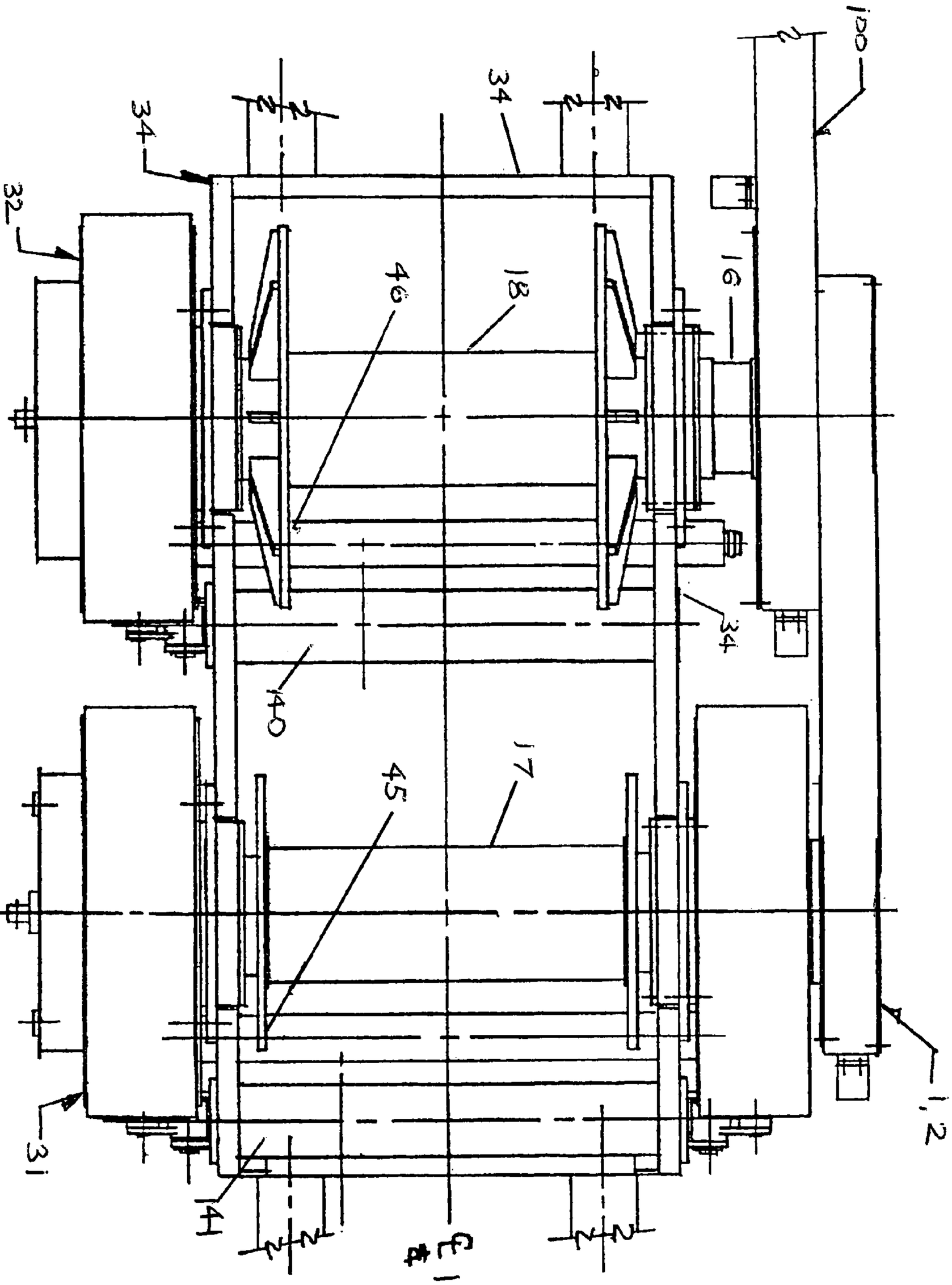


Fig. 1

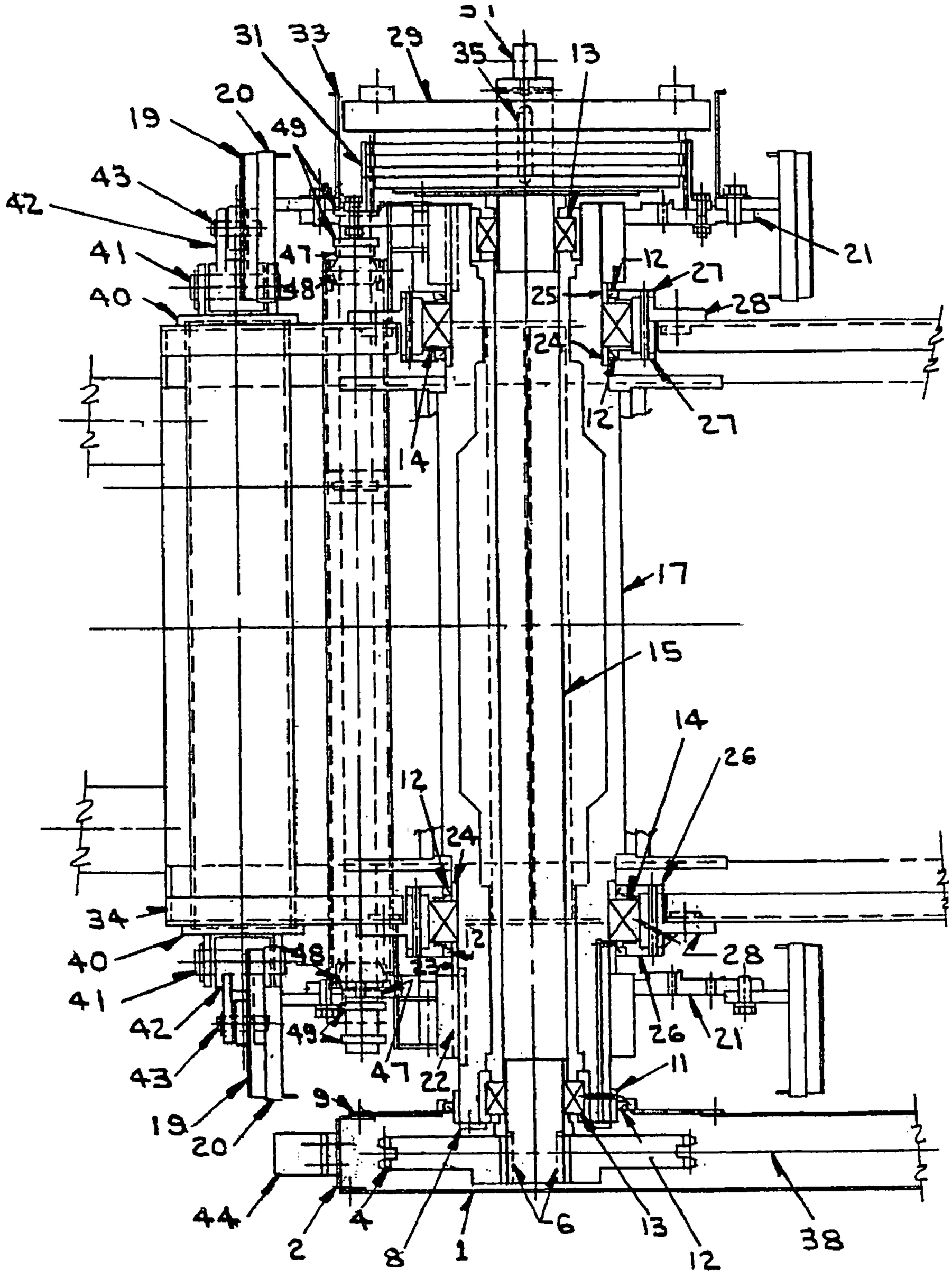

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Fig. 2

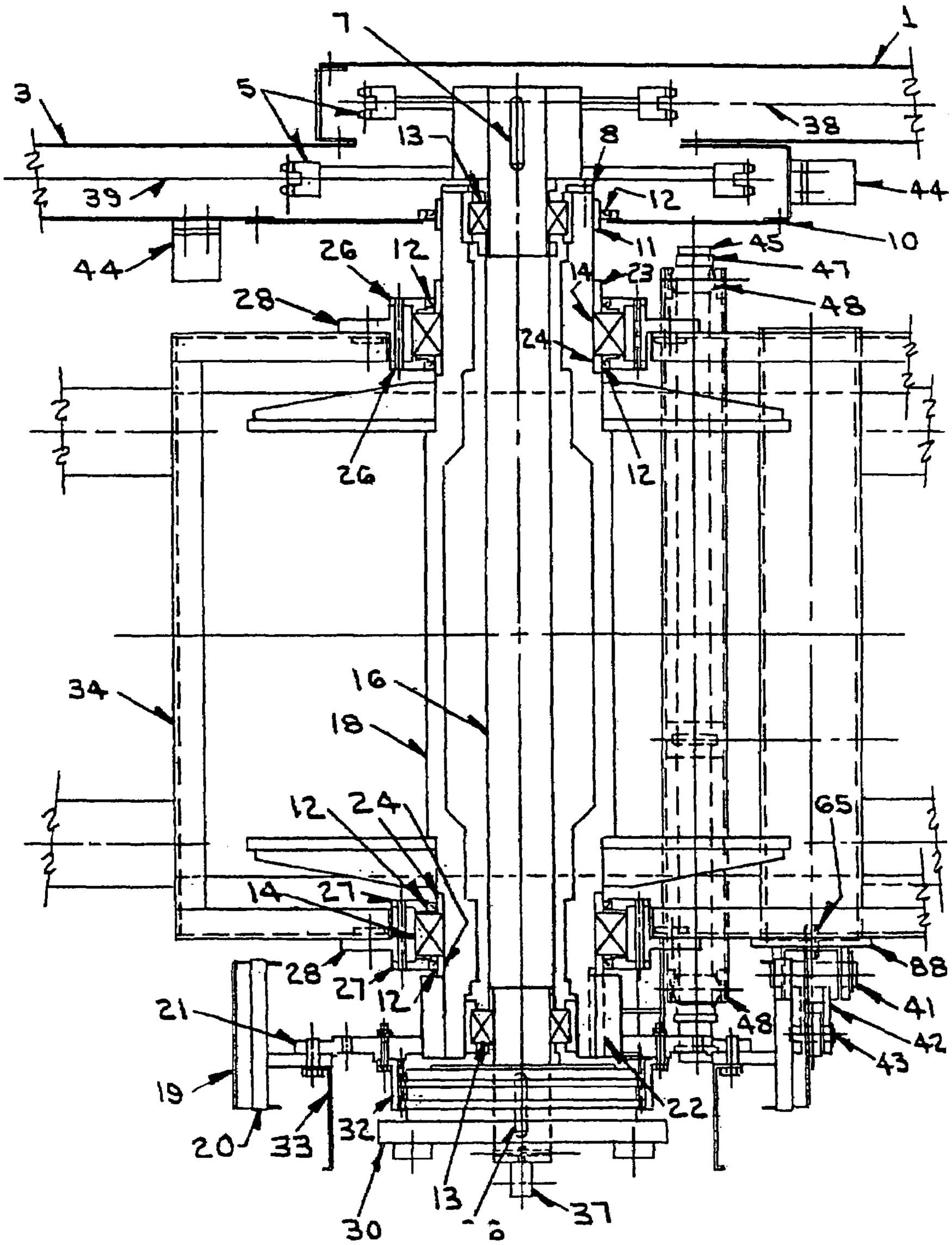
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Fig. 3

Fig. 4A

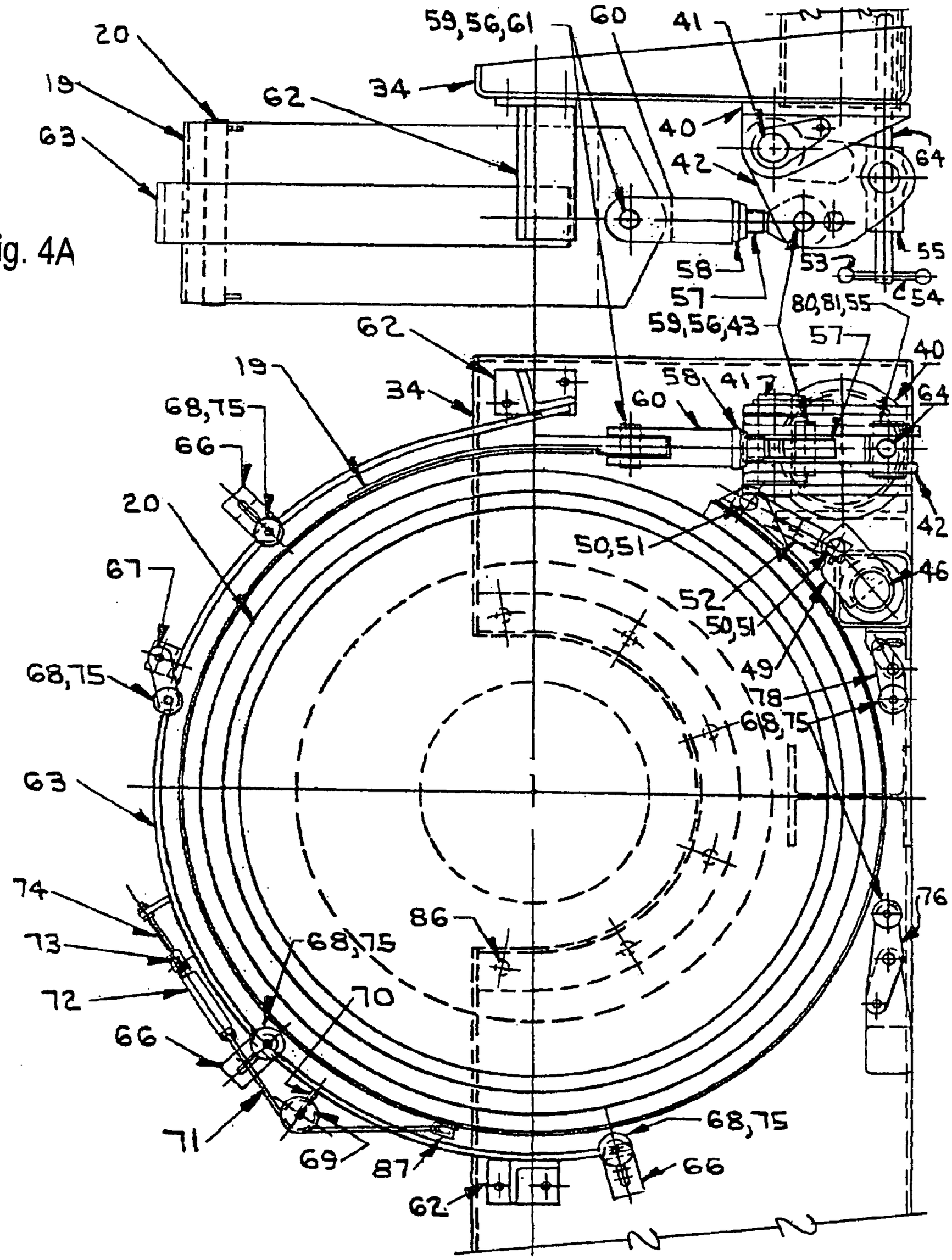
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Fig. 4B

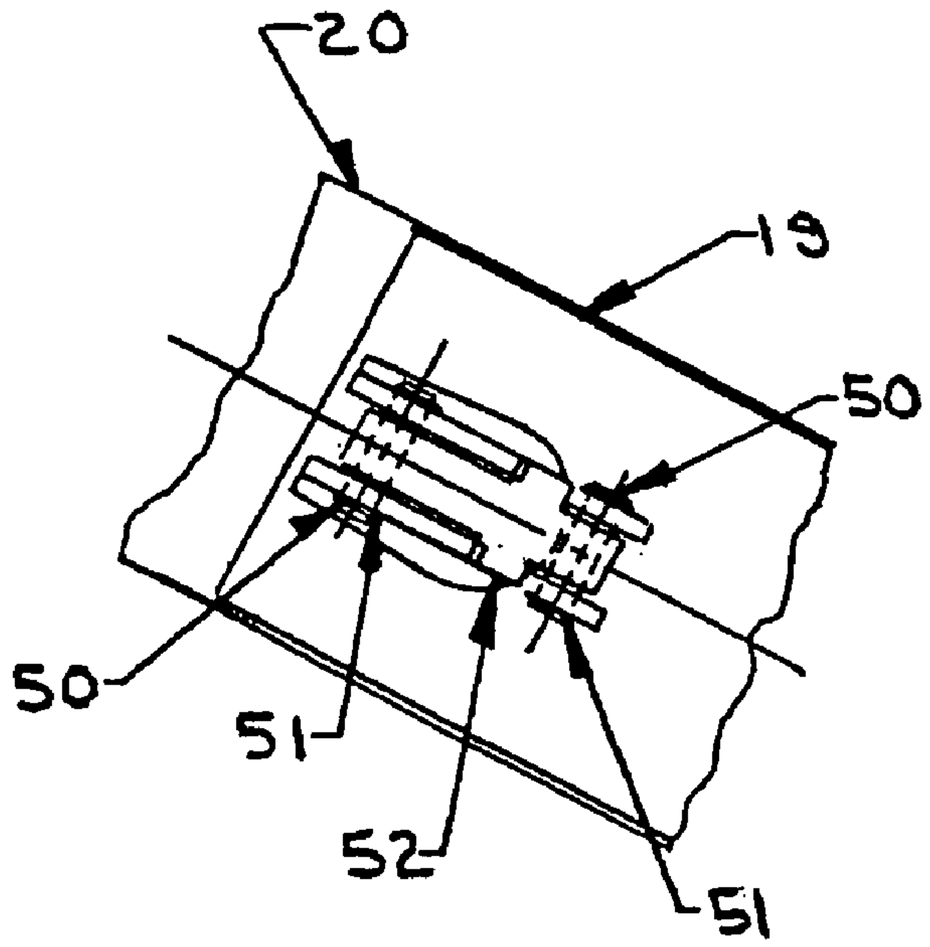

Fig. 5A

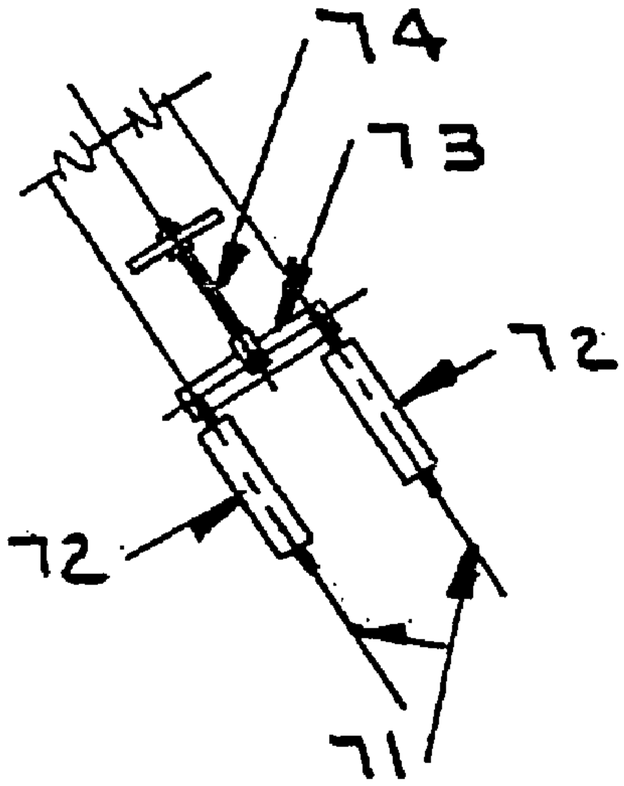

Fig. 5B

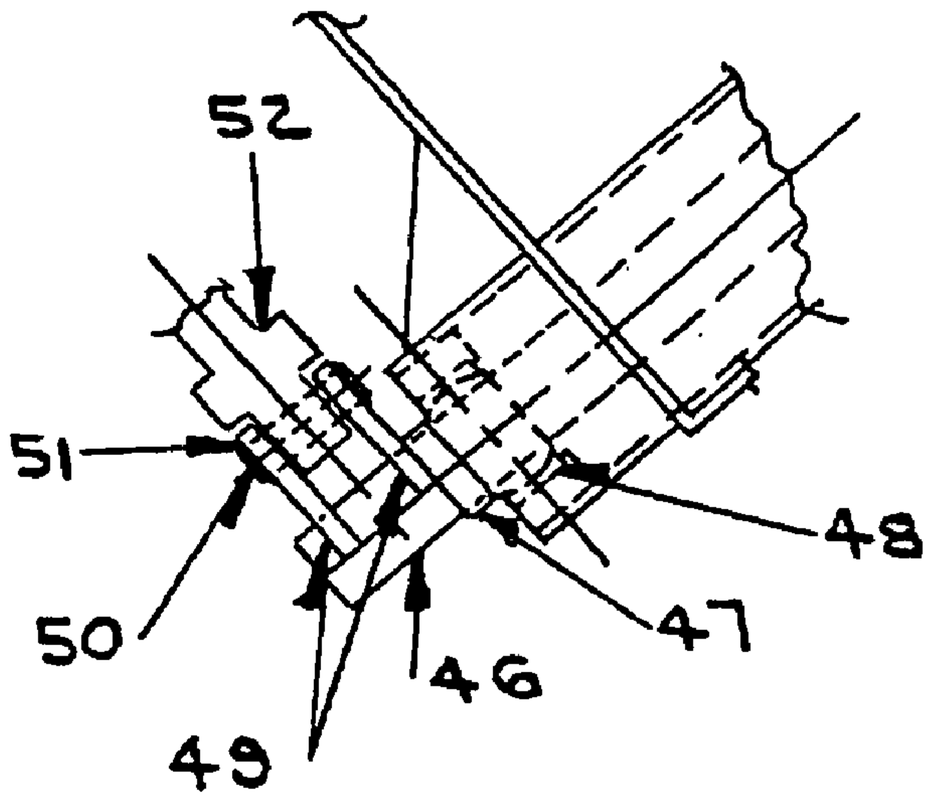

Fig. 5C

DRAWWORKS APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application Ser. No. 60/483,469, filed Jun. 30, 2003.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates generally to a drawworks apparatus having a drive mechanism and a brake mechanism that are positioned externally relative to the operating area of the drawworks frame and a shaft which is isolated from wireline pull generated during operation of the drum spool.

2. Description of the Related Art

The drawworks is a type of winch used in the oil well drilling and service industry as a portion of a drilling or servicing rig to raise and/or lower items such as tools and lengths of pipe from a well bore from which oil or other hydrocarbons are produced.

The drawworks typically includes a large-diameter spool that typically supports a length of cable, one or more brakes, a drive system connecting the spool to a power source, and other auxiliary devices that may assist in the lowering and raising items into a well bore.

However, major disadvantages plague conventional drawworks designs: for instance, a major portion of the cost of manufacturing a conventional drawworks is due to the complexity of its design.

Also, a significant portion of the cost of operating a well servicing or drilling rig is maintenance. The maintenance cost is influenced greatly by the number of components requiring servicing and their accessibility.

Moreover, drumshaft failures cause the loss of braking ability in conventional drawworks and are much more likely to occur in a conventional drawworks due to the fact that it carries the line pull and must also absorb shock loads transmitted through the wire line spool.

Still another common problem with conventional drawworks is the pliability of the brake bands. The pliable nature of the brake bands is often caused by insufficient anchoring of the dead end of the brake band.

Yet and still another problem in conventional drawworks designs occurs at the brake live end, particularly, as the brake blocks wear, the brake band wraps further around the brake flange to allow the brake live end linkage to break over center and unexpectedly release the brakes.

It is still another problem with conventional drawworks designs of experiencing failure due to contamination of the clutches' frictional surfaces with oil or other foreign debris and materials. This problem is also associated with the conventional internal mounting of the brakes and other components within the drawworks frame.

An additional problem associated with conventional drawworks the use of various types of seals, usually in the form of some type of labyrinth, to prevent oil from traveling to the clutch. This is not a very reliable technique and results in many drawworks failures.

Yet and still a further problem associated with conventional drawworks apparatus is the fact that the wire line clamp is virtually hidden by the brake flange, the drawworks frame and guards, or the wear plates placed on the inside surface of the drum end.

SUMMARY OF THE INVENTION

It is one aspect of the invention to provide a drawworks apparatus that reduces the complexity in conventional drawworks design without sacrificing performance, versatility or durability. The reduction of design complexity is accomplished by eliminating parts, which is made possible by a novel arrangement of drawworks components.

It is another aspect of the invention to provide a drawworks apparatus in which those components that have been traditionally shown of frequent servicing more accessible by locating them outside of the drawworks frame. For instance, the drawworks apparatus in accordance with the invention provides a novel location for connecting the wire line spool to the drawworks frame via a set of bearings, thereby making it possible to locate the brakes externally, i.e., outside the drawworks frame and the working or operating area of the drawworks wherein the raising and lowering of equipment occurs. Two resulting benefits of arranging the brakes outside the drawworks frame are cooler running brakes and easier maintenance of the brakes. The bearings provided to connect the wire line spool to the drawworks frame are selected on the basis of size and not according to load capacity. Consequently, the fatigue-life rating greatly exceeds the life expectancy of the rest of the rig. Another advantage of locating the bearings for connecting the wire line spool to the drawworks frame in such a manner is that it removes the wire line pull from the drumshaft of the main drum spool and the sand drum spool, thereby reducing its required size and strength as well as improving its reliability.

It is still another aspect of the invention to provide a drawworks apparatus that continues to provide braking function even in the event of drumshaft failure. This is a result of positioning the drumshafts relative their respective main drum spool and sand drum spool in a manner in which they are only required to carry chain pull, the weight of relatively light-weight components, and the torsional loads need to rotate the spools. This novel arrangement prevents the loss of braking capacity in the event of a drumshaft failure.

Yet and still another aspect of the invention is to provide a drawworks apparatus that uses a novel design of dead-end components in a brake system that permits the use of many common components on various sizes of drawworks while utilizing the basic drawworks design. Among the common components are such major items as the drawworks frame, brake beam, bell cranks and an equalizer screw. This is either impossible or impractical for conventional drawworks designs. Thus, the cost of producing a particular piece of machinery can be reduced by using as many common components as possible and also by using components of other similar equipment.

Still a further aspect of the invention is to provide a drawworks apparatus which eliminates the need for outside equipment such as cranes, gin pole trucks, and heating devices to conduct field repairs and maintenance. The use of such equipment is common for conventional drilling and well servicing rigs. For example, hubs are commonly shrink or press fitted the drive spool drum shafts on which they are mounted, and thus, heating devices such as torches are required to remove them. Because the drive system and the brake assembly of the drawworks apparatus in accordance with the invention are located outside of the working area of the drawworks frame, the drawworks components may be arranged and sized in such a manner that they can be disassembled and reassembled by hand without having to

pull hubs from the drive spool drum shafts using outside equipment such as heating devices.

It is still another aspect of the invention to provide a drawworks apparatus having an arrangement of working components that positions the crutches and the brakes outside both the drawworks frame, i.e., the working or operating area, and the chain drive cases. While some conventional drawworks designs locate the clutch outside the drawworks frame and the chain case, it is not physically separated from the chain case. The external mounting of the clutches and brakes in the drawworks apparatus of the invention reduces the likelihood of failure due to contamination of the clutches' frictional surfaces with oil or other foreign debris and materials. Since the clutches and brakes are used to control the raising and lowering of very heavy loads on the rig, any failure of these devices could have disastrous consequences.

Yet and still an additional aspect of the invention is to provide a drawworks apparatus that positions the brakes, flanges and the clutch relative to the drawworks frame that permits ease in inspection and servicing of the wire line clamp located at the drum end side of the wire line spool. Experienced professionals in the operation of oil well drilling and well drilling and servicing rigs find it absolutely essential to keep the wire line clamp properly tightened at all times, therefore, easy accessibility is very desirable. Therefore, unlike conventional drawworks designs, there are no such obstructions on the drawworks of the present invention.

The novel configuration of the drum spool allows the drumshaft bearings to be located very close to the only applied radial loads, keeping the applied bending moments to a minimum for a given chain pull. This condition permits the user of a smaller, light-weight drumshaft that would be otherwise possible, and at the same time maintains a high factor of reliability.

The novel placement of the brake flange facilitates the design of a very narrow, lightweight drawworks frame. The drawworks frame in accordance with the invention may be sized sufficiently narrow so that its side panels can be attached (via a welding operation) directly to the main structural members of the carrier or trailer upon which it is mounted. The relatively large weld length afforded in this design significantly reduces to a low level the weld stresses at the point of the drawworks attachment, thereby enhancing the reliability of the weld. Moreover, since the drawworks requires no gusseting for attachment to the carrier frame, both costs and complexity in design are reduced. Accordingly, the direct attachment of the drawworks side plate to the carrier frame increases the strength and rigidity of both members.

The drawworks apparatus in accordance with the invention also utilizes a strong structural member called a brake beam in which to anchor the brake band. This member is sized for a minimum deflection that yields an extremely strong member. A contributing factor in the pliable brake band used in conventional drawworks designs is the eccentric force exerted on the dead end of the brake brand. Besides being too pliable, conventional brake bands are prone to lift upwardly relative to the flange surface. This problem is cured in the drawworks apparatus of the invention by anchoring the brake bands using a component(s) that exerts a tangential pull on the brake band.

The drawworks apparatus in accordance with the invention utilizes a novel feature of a dead end equalizer by incorporating a threaded trunnion block for removing the bending moment form the trunnion pin located in the bell crank. Conventional drawworks designs threads the equalizer screw through a threaded hole in the trunnion pin which absorbs the axial load placed on the equalizer screw when the brakes are applied. The drawworks apparatus of the invention utilizes a trunnion pin with a drilled rather than threaded hole through which the equilizer screw passes. This is advantageous since the trunnion pin is placed in a shear-loaded condition, essentially eliminating any bending loads. In the conventional design, the trunnion pin is strong in shear but relatively weak in bending due to both the moment arm of the applied load and the loss of material caused by the hole through which the equalizer screw passes.

Unlike conventional designs, the drawworks apparatus in accordance with the invention includes a linkage system that does not permit the brake shaft to rotate over center. Such a feature is very important to crew safety since the correction of the condition on a conventional rig requires a crew member to place himself virtually inside the drawworks, where the slightest error can have fatal results. The load may drop out of control when the brakes pass over center if the operator fails to catch the load with the slips.

These and other objects, features and advantages of the invention will become more apparent from the following description when taken in conjunction with the detailed drawings that show, for purposes of illustration only, the preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The advantages of the invention will become more apparent to those skilled in the art in conjunction with the detailed description of the preferred embodiments of the invention, in which:

FIG. **1** is a top plan of the drawworks apparatus in accordance with the invention;

FIG. **2** is a top cross-sectional view of the main drum section of the drawworks apparatus;

FIG. **3** is a top cross-sectional view of the sand drum section of the drawworks apparatus;

FIGS. **4**A and **4**B are side and front cross-sectional views of the brake system of the drawworks apparatus;

FIGS. **5**A–**5**C are top cross-sectional views of the brake linkage assemblies of the drawworks apparatus.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to drawing FIGS. **1**–**5**, which show in detail a winch or power transmission apparatus, commonly called a drawworks, including drawworks frame **34**, main drum spool **17** and auxiliary or sand drum spool **18** in substantially parallel relation to main drum spool **17**. Also provided is a suitable drive device and a brake assembly **31**, **32** for main drum spool **17** and sand drum spool **18**. By way of suitable bearings **14**, main drum spool **17** and sand drum spool **18** are directly attached to the drawworks frame **34**. Particularly, main drum spool **17** is supported for rotation on drawworks frame **34** via bearings **14** while sand drum spool **18** is supported for rotation on drawworks frame **34** via bearings **14**.

Central shaft **15** of main drum spool and central shaft shaft **16** of sand drum spool **18** are concentric with their respective drum spool **17**, **18** and extend longitudinally outward through respective shaft bores of the spools **17**, **18**. Shafts **15**, **16** are rotatably mounted preferably via anti-friction bearings **13** at each end of its respective drum spool **17**, **18**. Thus, main drum spool **17** and sand drum spool **18** are supported by frame **34**, and main drum shaft **15** is

supported by main drum spool **17** and sand drum shaft **16** is supported by sand drum spool **18**. Accordingly, by arranging main drum spool **17** and sand drum spool **18** to support their respective drum shafts **15**, **16**, any applied radial loads are transmitted back to drawworks frame **34**. In a manner that will be explained hereafter, the structural configuration and relationship between shafts **15**, **16**, drum spools **17**, **18** and frame **34** is advantageous since the braking ability of the drawworks is unaffected by any failure to drum shafts **15**, **16** during hoisting operation.

As shown in FIG. **2**, a suitable drive device **1**, **2** is provided for driving main drum spool **17** and sand drum spool **18**. A driving source (not shown) is connected to transmission chain **100** which is in turn connected via sprocket **5** mounted to sand drum shaft **16**. Drumshaft **15** for main drum spool **17** supports clutch **29** on one end and sprocket **4** on the other end. Thus, the torque necessary to rotate main drum spool **17** is input through sprocket **4**. The torque is transmitted through key **35** loaded in shear to drumshaft **15**, and from there the torque is transmitted through another key **6** to the hub of friction clutch **29**. Upon any application of air pressure, the torque is transmitted through clutch drive ring **31** to spider **29** mounted on the drum spool extension. Spider **21** is also the component to which one of the brake flanges **20** is mounted. The torque applied to sprocket **4** which is mounted on the end of the main drum drumshaft **15** is transmitted to sprocket **4** by way of chain drive system **1**, **2**, whereby driver sprocket **5** of which is located on the end of sand drum drumshaft **16**. During the time that the main drum spool **17** is in operation, sand drum drumshaft **16** functions as a jackshaft, i.e., it functions as an intermediate shaft between the prime mover and the driven shaft (in this case, main drum drumshaft **15**). It should be understood by those of ordinary skill that any conventional driving device known in the art may be used to drive both main drum spool **17** and sand drum spool **18**.

The drawworks of the invention is provided with a brake assembly **31**, **32** for controlling the rotation of each drum spool **17**, **18** during the operation of the drawworks apparatus, i.e., when cable is being payed out to lower items. The respective brake assemblies **31**, **32** for main drum spool **17** and sand drum spool **18** includes brake shaft **45** for main drum spool **17** and brake shaft **46** for sand drum spool **18**, each brake shaft **45**, **46** being rotatably mounted within a shaft bore to drawworks frame **34**. Main drum spool **17** is provided with a pair of brakes located at each end of frame **34** while sand drum spool **18** is provided with a single brake located opposite drive system.

Brake flanges **20** are mounted to each drum spool **17**, **18** on an extended portion of each respective drum spool **17**, **18**. The mounting of the brake flanges **20** is accomplished through the use of spider **21** with a keyed hub **22**. The main drum spool **17** has two brake flanges **20** mounted on it, and are positioned externally relative to the drawworks frame **34**. Sand drum spool **18** has a single brake flange **20** that is also mounted externally relative to the drawworks frame **34**. Anti-friction bearings **13** are mounted within the bore of each drum spool **17**, **18** to support a respective drumshaft **15**, **16** in a manner which does not restrict rotation of the shafts **15**, **16**. This produces what is commonly known as a "live shaft." Accordingly, the braking ability of the drawworks apparatus is unaffected by any failure to shafts **15**, **16** because the brake assemblies **31**, **32** are structurally connected directly to drum spools **17**, **18** instead of to shafts **15**, **16** (i.e., shafts **15**, **16** are structurally isolated from the brake assembly). While the sand drum spool **18** has one brake flange **20** mounted on it in accordance with this aspect of the invention, it could have two brake flanges **20** attached to it.

As shown in FIG. **3**, the sand drum drumshaft **16** at one end is rotatably connected to sprocket **5** having two sets of sprocket teeth attached to it by way of a keyed hub **7**. The opposite end of sand drum drumshaft **16** is rotatably connected to clutch **30** mounted via key **36**. The torque necessary to rotate the sand drum spool **18** is input through sprocket **5** mounted on sand drum drumshaft **16**, and is transmitted through key **36** which is loaded in shear to sand drum drumshaft **16**. From there the torque is transmitted through key **7** loaded in shear to the hub of clutch **30**, and upon application of air pressure, the torque is transmitted through clutch drive ring **32** to spider **21** mounted on an extension to sand drum spool **18**. Spider **21** is also the component to which brake flange **20** for sand drum spool **18** is mounted.

The torque applied to sprocket **5** which is mounted to one end of sand drum drumshaft **16** is transmitted thereto by way of chain drive system **1**, **2** and **3**. Chain drive system **1**, **2**, and **3** is also available for use in transmitting power to an assist brake, which may be in the form of a band, water or electric brake used to absorb the tremendous energy generated when the drawworks apparatus is engaged in an operation of lowering a length of pipe or casing into a well bore.

As illustrated in FIGS. **4**A and **4**B, the drawworks in accordance with the invention utilizes band brake **19** having at least one brake blocks for reducing the speed of rotation of both main drum spool **17** and sand drum spool **18** so as to control the rate at which the length of cable from drum spools **17**, **18** are payed out. As also shown in FIGS. **5**A–**5**C, band brake **19** is mounted at a "live end" thereof via a first linkage system which includes ears **49**, pin **50**, retaining ring **51**, link **52**, to brake shaft **46** and at the "dead end" via a pivotably adjustable linkage system which includes bell crank **42** and equilizer **64**.

Band brake **19** may take the form of a self-energizing actuated by a force applied by the driller or operator to a torque lever or handle (not shown) to tighten brake band **19** and thereby engage the brake blocks mounted to brake band **19** with the surface of the spool **17**, **18**. Such actuation force may be transmitted using a pivotably adjustable linkage assembly to the "dead end" of brake bands **19**. The drawworks apparatus utilizes a tubular member or brake beam **140**, **141** that longitudinally extends through drawworks frame **34** and is cantilevered at ends thereof. The brake bream **140**, **141** includes a pair of brake beam anchors **40** at each thereof which are welded into drawworks frame **34** to anchor the "dead end" of brake band **19** via a cantilever arrangement. Brake beam **140**, **141** is advantageous in that it maintains its strength regardless of the direction of the applied dead end brake force.

For the main drum spool **17**, each anchor **40** of brake beam **140** extends past the side plates of drawworks frame **34**, and a bell crank **42** is pivotably mounted at each respective end thereof. Preferably, brake beam anchors **40** are not welded until the size of the brake becomes known as it may become necessary to rotate it about its axis to accommodate a specific flange size. Anchors **40** at each end of brake beam **140** have lugs with holes bored therein, and are rotatable to accommodate various sizes of brakes. Thus, the line of force from the dead end of brake band **19** passes through its centerline regardless of the size of brake band **19** without the need for repositioning brake beam **140**.

Bell crank **42** which includes a hole bored at its pivot point is placed at the end of each anchor **40** and by way of pivot pin **41** attached thereto. A plurality of holes may be

bored at the three locations in the bell crank **42**: one at pivot point **41**, one at the center of brake flange **20**, and one at the center of brake beam anchors **40**. Brake bands **19** are pivotably connected through an adjustable linkage to bell crank **42** with a pin hole through the bored holes at the center of the brake flange **20**. Substantially spherical bushings (not shown) are used at both ends of linkage to ensure a free, non-binding operation, while equalizer screw **64** connects the bell cranks **42** to the "dead end" of band brakes **19**.

The following procedure should be used to install the equalizer screw **64**: Firstly, equalizer screw **64** should be inserted longitudinally through brake beam **140** through the hole in each anchor **40**. Equalizer screw **64** has left hand threads at one end and right hand threads at the other end; therefore, simply turning the screw **64** will either tighten or loosen the brake linkage. Secondly, before bell cranks **42** are attached to brake beam **140**, place threaded trunnion block **55** between the lugs of the bell crank **42**, making sure to align it with the trunnion pin holes of the bell crank **42**. Thirdly, insert trunnion pin **80** through the bored holes in bell crank **42** and threaded trunnion block **55**. Finally, take the three-pieced assembled piece, i.e., bell crank **42**, trunnion block **55** and trunnion pin **80**, and insert equalizer screw **64** through the hole in trunnion pin **80**, then rotate equalizer screw **64** for insertion into trunnion block **55**. Continue doing this until pivot pin **41** is installed to join bell crank **42** to each brake beam anchor **40**.

The equalizer assembly **64** is provided for main drum spool **17** to ensure that an equal braking force is placed on each brake band **19**. The "live end" of brake band **19** is coupled to a rotating brake shaft **46** through a link pin **50** on one end to lugs welded to the brake shaft **46** on the other end. This linkage is similar to a convention design except that link **52** has lugs on its sides that connect bracket ears **49** to brake shaft **46** in such a manner that brake shaft **46** cannot rotate past center. Brake bands **19** are centered over brake flange **20** by a system of rollers **66**, **67** and **68** and pull-off springs **72**. The brake centering system holds brake bands **19** off of flange **20** during operation of the drawworks and positions brake bands **19** to properly function when actuated by an operator.

Support brackets **76**, **77**, **78** and **79** are formed around the brake band **19** and flange **20** with an adjustable roller **66**, **67** and **68** strategically placed around it. Pull-off springs **72** are provided at the live end of the brake band **19** and at the drum center line. When actuated, springs **72** pull brake band **19** back against rollers **66**, **67** and **68** which are adjustable to hold brake band **19** approximately ⅛ inch off of flange **20**.

Sand drum brake assembly **32** is constructed similarly to main drum brake assembly **31** except that brake assembly **32** does not require an equalizer assembly since it preferably uses only one brake **19**.

It is apparent that innumerable variations of the preferred embodiments described hereinbefore may be utilized. However, these as well as other variations are believed to fall within the spirit and scope of the invention as covered by the claims attached herein.

What is claimed is:

1. A drawworks apparatus for raising and lowering items down a well bore, said drawworks comprising:

a frame having a working area within inner surfaces thereof where the raising and lowering of items occurs;

a main drum spool having at least a portion situated within said working area for raising and lowering items down the well bore via a length of cable wound thereon, said main drum spool extending through and rotatably mounted directly to said frame by a first set of bearings;

a main drum shaft rotatably and concentrically supported by said main drum spool in a manner in which said main drum shaft is isolated from wireline pull from said main drum spool imposed on said main drum spool during operation of said drawworks;

an auxiliary drum spool for raising and lowering items down a well bore via a length of cable wound thereon, said auxiliary drum spool rotatably supported by said frame by a second set of bearings;

an auxiliary drum shaft rotatably and concentrically supported by said auxiliary drum spool in a manner in which said auxiliary drum shaft is isolated from wireline pull from said auxiliary drum spool imposed on said auxiliary drum spool during operation of said drawworks;

a drive mechanism located outside of said working area for rotating said main drum spool and said auxiliary drum spool, said drive mechanism providing a driving force input through said auxiliary drum shaft via an input chain drive, said main drum spool having a clutch for engaging said drive mechanism located outside the working area and externally separated from said input chain drive; and

a first brake assembly located outside of said working area, said first brake assembly being connected to said main drum spool so as to reduce the rate of rotation of said main drum spool during operation of said drawworks.

2. The drawworks apparatus of claim **1**, further comprising a second brake assembly connected to said auxiliary drum spool for reducing the rate of rotation of said auxiliary drum spool, said second brake assembly being connected to said auxiliary drum spool.

3. The drawworks apparatus of claim **2**, wherein said second brake assembly is connected to said auxiliary drum spool via a brake flange mounted outside the working area of said frame.

4. The drawworks apparatus of claim **3**, wherein said second brake assembly comprises a second band brake.

5. The drawworks apparatus of claim **1**, wherein said first brake assembly comprises a first band brake.

6. The drawworks apparatus of claim **5**, wherein first said band brake is connected to said main drum spool via a pair of brake flanges mounted outside the working area of said frame.

7. The drawworks apparatus of claim **6**, wherein said first band brake is configured for actuation via a level which applies an adjustable braking force sufficient to reduce the rate of rotation of said main drum spool.

8. The drawworks apparatus of claim **7**, wherein said first band brake includes a brake band having at least one brake block mounted thereon, said brake band being connected to a rotatable brake shaft at a live end thereof via a first linkage assembly and to said frame at a dead end thereof via a second linkage assembly.

9. The drawworks apparatus of claim **8**, wherein said first linkage assembly comprises a bracket and a link mechanism having a plurality of lugs thereon for connecting said bracket to said brake shaft in such a manner that prevents said brake shaft from rotating past center.

10. The drawworks apparatus of claim **9**, wherein said second linkage assembly is adjustable and comprises a substantially tubular brake beam member which extends through and connected to said frame via a pair of anchors, a bell crank which is rotatably connected to each one of said

anchors, and an equalizer system rotatably connected at one end to said bell crank and at another end to the dead end of said brake band.

11. The drawworks apparatus of claim **10**, wherein said equalizer system comprises a threaded trunnion block sized for receipt by said bell crank, a trunnion pin having a drilled hole therein for receiving an equalizer screw, said trunnion pin being sized for receipt through respective concentric bored holes in said trunnion block and said bell crack, said drilled hole resulting in said trunnion pin being loaded in shear only.

12. The drawworks apparatus of claim **11**, wherein said equalizer screw is rotatably manipulatable to adjust the linkage between said brake band and said second linkage system.

13. The drawworks apparatus of claim **1**, wherein said drive mechanism comprises a chain drive mechanism.

14. The drawworks apparatus of claim **1**, wherein said main drum shaft and said auxiliary drum shaft are rotatably mounted via bearings to said main drum spool and said auxiliary drum spool respectively.

15. The drawworks apparatus of claim **14**, wherein said bearings comprise anti-friction bearings.

16. A drawworks apparatus comprising:

a frame which rotatably supports a drum spool, said drum spool supporting within an operating area of said frame where items are raised and lowered down a well bore a length of wire thereon for raising and lowering items down a well borg, said drum spool being mounted directly to said frame such that operational forces imposed upon said drum spool are transmitted directly to said frame;

a drive mechanism for rotating said main drum mechanism, said drive mechanism being located externally relative to said frame at a point outside of said operating area;

a band brake assembly positioned external to said frame and said operating area for reducing the rate of rotation of said main drum mechanism, said brake band assembly being connected at one end thereof to a rotatable brake shaft via a first linkage assembly and to said frame at a second end thereof via a second linkage assembly,

wherein said first linkage assembly includes a bracket and link connection for connecting said bracket to said brake shaft in such a manner that prevents said brake shaft from rotating past center.

17. The drawworks apparatus of claim **16**, wherein said second linkage assembly is adjustable and comprises a substantially tubular brake beam member which extends through and connected to said frame via a pair of anchors, a bell crank which is rotatably connected to each one of said anchors, and an equalizer system rotatably connected at one end to said bell crank and at another end to the dead end of said brake band assembly.

18. A drawworks apparatus comprising:

a frame which rotatably supports by direct connection a drum spool, said drum spool rotatably and concentrically supporting a drum shaft therein such that said drum shaft is isolated from wireline pull from said drum spool;

a drive mechanism connected to said drum shaft for driving said drum spool, said drive mechanism being positioned outside a working area of said frame where items are raised and lowered down a well bore;

a band brake assembly for reducing the rate of rotation of said drum spool, said band brake assembly being positioned outside of said working area and connected at one end thereof to a rotatable brake shaft via a first linkage assembly and to said frame at a second end thereof via an adjustable second linkage assembly,

wherein said second linkage assembly comprises a substantially tubular brake beam member which extends through and connected to said frame via a pair of anchors, a bell crank which is rotatably connected to each one of said anchors, and an equalizer system rotatably connected at one end to said bell crank and at another end to the dead end of said band brake assembly.

19. The drawworks apparatus of claim **18**, wherein said equalizer system comprises a threaded trunnion block sized for receipt by said bell crank, a trunnion pin having a drilled hole therein for receiving an equalizer screw, said trunnion pin being sized for receipt through respective concentric bored holes in said trunnion block and said bell crack, said drilled hole resulting in said trunnion pin being loaded in shear only.

20. The drawworks apparatus of claim **19**, wherein said equalizer screw is rotatably manipulatable to adjust the linkage between said brake band assembly and said second linkage system.

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